

## **SECTION 16361 SECONDARY UNIT SUBSTATIONS INSTALLATION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes indoor and outdoor secondary unit substations, each consisting of the following:
  - 1. Incoming section.
  - 2. Transformer.
  - 3. Secondary distribution section.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Section 16121, Medium Voltage Cable – 5-kV and 15-kV Insulated.
  - 2. Section 16196, Electrical Identification.
  - 3. Section 16450, Grounding.
  - 4. Section 16465, Electrical Busway System.

#### **1.3 REFERENCES**

- A. Institute of Electrical and Electronics Engineers (IEEE):
  - 1. C2-1997, National Electrical Safety Code.
  - 2. C37.121-1989, Standards for Switchgear – Unit Substations.
- B. Underwriters Laboratories, Inc. (UL):
  - 1. 486A, Wire Connectors and Soldering Lugs for Use with Copper Conductors.
  - 2. 486B, Wire Connectors for Use with Aluminum Conductors.

#### **1.4 SUBMITTALS**

- A. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
  - 1. Dimensioned concrete base, outline of secondary unit substation, conduit entries, and ground rod locations.
  - 2. Location of structural supports for structure-supported raceways, and busways.
  - 3. Location of lighting fixtures, sprinkler piping and heads, ducts, and diffusers.
- B. Field Test Reports: Written reports specified in Part 3.

#### **1.5 QUALITY ASSURANCE**

- A. Comply with IEEE C2.
- B. Comply with IEEE C37.121.
- C. Comply with NFPA 70.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in shipping splits in sizes that can be moved past obstructions in delivery path.
- B. Coordinate delivery of secondary unit substations to allow movement into designated space.
- C. Store secondary unit substation components protected from weather so condensation will not form on or in units. Provide temporary heating according to manufacturer's written instructions.
- D. Handle secondary unit substation components according to manufacturer's written instructions. Use factory-installed lifting provisions.

## 1.7 PROJECT CONDITIONS

- A. Service Conditions: IEEE C37.121, usual service conditions:

## 1.8 COORDINATION

- A. Coordinate layout and installation of secondary unit substations with other construction that penetrates floors and ceilings, or is supported by them, including light fixtures, HVAC equipment, and fire-suppression-system components.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

## PART 2 - PRODUCTS

- 2.1 Substation equipment are CMFE. See specification Section 16370 for equipment requirements and CM for actual equipment being provided.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and space conditions for compliance with requirements for secondary unit substations.
- B. Examine roughing-in of conduits and grounding systems to verify the following:
  - 1. Wiring entries comply with layout requirements.
  - 2. Entries are within conduit-entry tolerances specified by manufacturer and no feeders will have to cross section barriers to reach load or line lugs.
  - 3. Examine walls, floors, roofs, and concrete bases for suitable conditions for secondary unit substation installation.
  - 4. Verify that ground connections are in place and that requirements in Division 16 Section "Grounding" have been met. Maximum ground resistance shall be 5 ohms at secondary unit substation location.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install secondary unit substations on concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

- B. Anchoring: Tack-weld or bolt secondary unit substation components to channel-iron sills embedded in concrete base. Install sills level and grout flush with floor or base.
- C. Terminate feeder conductors to the load side terminals of the appropriate breakers in accordance with the design drawings. Feeder cables shall be lashed per figure 44 of Cutler-Hammer instruction bulletin I.B.32-167-A. INSTRUCTIONS FOR MAGNUM DS METAL-ENCLOSED LOW-VOLTAGE SWITCHGEAR ASSEMBLIES WITH MAGNUM DS BREAKERS.

### 3.3 IDENTIFICATION

- A. Identify field-installed wiring and components and provide warning signs as specified in Section 16196 "Electrical Identification."
- B. Operating Instructions: Frame printed operating instructions for secondary unit substations, including key interlocking, control sequences, elementary single-line diagram, and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of secondary unit substation.

### 3.4 CONNECTIONS

- A. Ground equipment to main electrical ground bus as indicated.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.5 CLEANING

- A. After completing equipment installation and before energizing, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish. Vacuum interiors of secondary unit substation sections.

### 3.6 FIELD QUALITY CONTROL

- A. Testing: Contractor will engage a qualified testing agency to perform the following field quality-control testing:
- B. Testing: Perform the following field quality-control testing:
  - 1. After installing secondary unit substation but before primary is energized, verify that grounding system at the substation tested at the specified value or less.
  - 2. After installing secondary unit substation and after electrical circuitry has been energized, test for compliance with requirements.
  - 3. Set field-adjustable switches and circuit-breaker trip ranges as provided by the Construction Manager.
  - 4. Perform visual and mechanical inspection and electrical tests according to NETA ATS, Section 7, as it applies to all installed systems and devices. Certify compliance with the following test parameters:
    - a. Air-Interrupter Switch: Section 7.5.
    - b. Transformer: Section 7.2.
    - c. Secondary Distribution Section Switchgear and Switchboard Assemblies: Section 7.1.
    - d. Protective Relays: Section 7.9.
    - e. Instrument Transformers: Section 7.10.
    - f. Metering: Section 7.11.

- C. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
  - 1. Inspect field-assembled components, equipment installation, and electrical connections for compliance with requirements.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Test Reports: Prepare written report to record the following:
    - a. Test procedures used.
    - b. Test results that comply with requirements.
    - c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

### 3.7 FOLLOW-UP SERVICE

- A. Voltage Monitoring and Adjusting: After Substantial Completion, if requested by Owner, but not more than six months after Final Acceptance, perform the following voltage monitoring:
  - 1. During a period of normal load cycles as evaluated by Owner, perform seven days of three-phase voltage recording at the outgoing section of each secondary unit substation. Use voltmeters with calibration traceable to the National Institute of Science and Technology standards and with a chart speed of not less than 1 inch (25 mm) per hour. Voltage unbalance greater than 1 percent between phases, or deviation of any phase voltage from the nominal value by more than plus or minus 5 percent during the test period, is unacceptable.
  - 2. Corrective Action: If test results are unacceptable, perform the following corrective action, as appropriate:
    - a. Adjust transformer taps.
    - b. Rebalance loads.
    - c. Prepare written request for voltage adjustment by electric utility.
  - 3. Retests: Repeat monitoring, after corrective action has been performed, until satisfactory results are obtained.
  - 4. Report: Prepare a written report covering monitoring performed and corrective action taken.
- B. Infrared Scanning: Perform as specified in Division 16 Section 16352 "Medium-Voltage Switchgear."

### 3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train personnel identified by the Construction Manager to adjust, operate, and maintain systems.
- B. Engage a factory-authorized service representative to train identified maintenance personnel to adjust, operate, and maintain secondary unit substations.
  - 1. Train identified maintenance personnel on procedures and schedules for energizing, tap changing, troubleshooting, service, and maintenance.
  - 2. Review data in maintenance manuals. Refer to General and Supplementary Conditions section, "Closeout Procedures."
  - 3. Review data in maintenance manuals. Refer to General and Supplementary Conditions section, "Operation and Maintenance Data."
  - 4. Schedule training with Construction Manager with at least seven days' advance notice.

**END OF SECTION 16361**